CT.2-8

CT02
11381

ornl

ORNL/TM-12390

OAK RIDGE
NATIONAL
LABORATORY

MARTIN MARIETTA

Results of the Independent Radiological Verification Survey at the former Bridgeport Brass Company Facility, Seymour, Connecticut (SSC001)

R. D. Foley
D. E. Rice
J. F. Allred
K. S. Brown

MANAGED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

ORNL/TM-12390

HEALTH SCIENCES RESEARCH DIVISION
Environmental Restoration and Waste Management Non-Defense Programs
(Activity No. EX 20 20 01 0; ADS317AEX)

Results of the Independent Radiological Verification Survey at the former Bridgeport Brass Company Facility, Seymour, Connecticut (SSC001)

R. D. Foley, D. E. Rice, J. F. Allred, K. S. Brown

Date Issued - March 1995

Investigation Team
R. D. Foley–Measurement Applications and Development Manager
W. D. Cottrell – FUSRAP Project Director
R. D. Foley – Survey Team Leader

Survey Team Members

J. P. Abston
J. F. Allred
A. C. Butler[1]
R. C. Gosslee
R. A. Mathis
M. E. Murray
V. P. Patania
D. E. Rice
R. E. Rodriguez
D. A. Rose
W. H. Shinpaugh[1]

[1]Midwest Technical, Inc.

Work performed by the
MEASUREMENT APPLICATIONS AND DEVELOPMENT GROUP

Prepared by the
OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831-6285
managed by
MARTIN MARIETTA ENERGY SYSTEMS, INC.
for the
U. S. DEPARTMENT OF ENERGY
under contract DE-AC05-84OR21400

CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGMENTS

This project was sponsored by the Office of Environmental Restoration, U.S. Department of Energy, under contract DE-AC05-84OR21400 with Martin Marietta Energy Systems, Inc. The authors wish to acknowledge the contributions of W. D. Cottrell, J. M. Lovegrove, D. A. Rose, D. A. Roberts, R. C. Gosslee, R. E. Rodriguez, R. A. Mathis, R. F. Carrier, T. R. Stewart and V. P. Patania of the Measurement Applications and Development Group, Oak Ridge National Laboratory, for sample preparation and participation in the analyses, editing, and reporting of data for this survey.

ABSTRACT

At the request of the U.S. Department of Energy (DOE), a team from Oak Ridge National Laboratory (ORNL) conducted an independent radiological verification survey at the former Bridgeport Brass Company Facility, Seymour, Connecticut. The survey was performed from September of 1992 to March of 1993. The purpose of the survey was to determine whether residual levels of radioactivity inside the Ruffert Building and selected areas adjacent to the building were remediated to levels below DOE guidelines for FUSRAP sites. The property was contaminated with radioactive residues of ^{238}U from uranium processing experiments conducted by Reactive Metals, Inc., from 1962 to 1964 for the Atomic Energy Commission. A previous radiological survey did not characterize the entire floor space because equipment which could not be moved at the time made it inaccessible for radiological surveys. During the remediation process, additional areas of elevated radioactivity were discovered under stationary equipment, which required additional remediation and further verification.

Results of the independent radiological verification survey at the former Bridgeport Brass Company Facility confirm that, with the exception of the drain system inside the building, residual uranium contamination has been remediated to levels below DOE guidelines for unrestricted release of property at FUSRAP sites inside and outside the Ruffert Building. However, certain sections of the drain system retain uranium contamination above DOE surface guideline levels. These sections of pipe are addressed in separate, referenced documentation.

Results of the Independent Radiological Verification Survey at the former Bridgeport Brass Company Facility, Seymour, Connecticut (SSC001) *

INTRODUCTION

Between 1962 and 1964, Reactive Metals, Incorporated, conducted experimental activities related to the development of nuclear energy at a 60-acre facility located at 15 Franklin Street, Seymour, Connecticut. The city of Seymour lies on the Naugatuck River approximately ten miles northwest of New Haven. Experimental activities at the facility included the machining, rolling, and extruding of uranium billets in the Mannesman Piercing Experiment, which was conducted under contract to the Atomic Energy Commission in the presently-named Ruffert Building. In 1964 the property was purchased by the Bridgeport Brass Company. Later the facility was purchased by an employee group and renamed Seymour Specialty Wire Company. The Ruffert Building was leased to and occupied by the Electric Cable Company at the time of both scoping and verification surveys.[1]

At the request of the U.S. Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted an independent radiological verification survey at the former Bridgeport Brass Company Facility, Seymour, Connecticut. The survey was performed from September of 1992 to March of 1993. The purpose of the survey was to determine whether radioactivity, from residues of ^{238}U inside the Ruffert Building and selected areas adjacent to the building, was remediated to a level below acceptable DOE guideline levels for FUSRAP sites. In the previous scoping survey, the entire floor space was not accessible because of equipment which could not be moved at the time. During the remediation process by Bechtel National, Inc. (BNI), additional areas of elevated radiation were discovered under stationary equipment, which required additional remediation and further verification.

VERIFICATION PROCEDURES

A description of the typical survey methods and instrumentation providing guidance for the verification survey may be found in *Procedures Manual for the ORNL Radiological Survey Activities (RASA) Program,* ORNL/TM-8600 (April 1987).[2]

---

*The survey was performed by members of the Measurement Applications and Development Group of the Health Sciences Research Division at Oak Ridge National Laboratory under DOE contract DE-AC05-84OR21400.

Gamma radiation levels were determined using portable NaI gamma scintillation meters; beta/gamma measurements were made with GM "pancake" probes; alpha measurements were made with ZnS "beer mug" detectors. Large-area proportional detectors were used to scan floors.

The outdoor survey in the vicinity of the building included:

- Collection and analysis of systematic and biased soil verification samples at the north end of the building from an area beneath the floor of the former scale room and an area (approximately 12 ft. by 12 ft.) adjacent to a concrete pad north of the Ruffert Building after the areas were remediated. Gamma and beta radiation levels were measured after each remedial phase until the particular area was cleaned to within DOE guidelines. Figure 1 shows elevated areas, prior to remediation, and verification sample locations.
- Collection and analysis of a sediment sample from a storm drain and a rock sample from a granite stone outcrop.

The indoor survey of the building included the following:

- Measurement of alpha and beta-gamma radiation levels in all accessible areas of the building, after remediation activities occurred and wherever areas of elevated radiation levels were indicated during surveying activities. Figure 2 is a diagram of the drain system inside the Ruffert Building. Drainlines were logged with a GM probe to the point of refusal, or to the next intersecting drain, or as far as practical in a noncontaminated line, for measurement of beta-gamma levels. Certain sections of the drain system had uranium concentrations above DOE surface guideline levels. The survey indicated maximum beta-gamma levels of 172,000 dpm/100 cm^2 in drains. Five contaminated drains were completely removed from a raised floor area in the northwest corner of Room 5 referred to as the pedestal area (see enlarged area on Fig. 2).
- Smears of selected floor, wall, and overhead surfaces for measurement of transferable alpha and beta-gamma radioactivity levels. All floor and overhead smears were within DOE FUSRAP guidelines. Figures 3 and 4 show smear locations on floor and overhead surfaces, respectively, inside the Ruffert Building. Smears were taken on five drains in the second floor laboratory (see Fig. 2).
- Sampling and radionuclide analysis of sediment verification samples from drains (Fig. 2) and systematic verification samples from floors (Fig. 3). Verification samples VS11 and VS13 are soil composite samples taken under the concrete where contaminated floor joints had been removed. Verification sample VS12 is a composite soil sample taken from soil underneath concrete at a drain opening where the drain and surrounding concrete had been removed.

VERIFICATION SURVEY RESULTS

DOE guidelines are summarized in Table 1. Typical background radiation levels for the Seymour, Connecticut area are presented in Table 2. These data are provided for comparison with survey results presented in this section. Background concentrations have not been subtracted from radionuclide concentrations measured in soil samples.

As equipment was moved during the remediation process, additional elevated areas were discovered, characterized, remediated and verified. All floor, wall, and overhead surfaces were verified to be within DOE guidelines and released by ORNL at the end of the verification survey. Second floor drains were verified to be below guidelines after on-site smear analysis, and limited beta-gamma scans using a modified GM tube/Bicron instrument.

Radionuclide analysis was performed on systematic, biased, and sediment verification samples collected at locations inside and outside the building. Results of analysis are listed in Table 3. Although samples VS4 and VS5 were above background levels for ^{238}U for the Seymour, Connecticut area (see Table 2), they were well below DOE guidelines. Drainline sediment samples VE7, VE8, and VE9 from drains (Fig. 2) showed ^{238}U concentrations of 100, 320, and 2400 pCi/g, respectively. This report does not provide complete verification of the floor drain system. The drain system was also assessed by a hazard assessment, and, based on the hazard assessment, DOE approved supplemental standards for the floor drain system.[3,4]

All 170 smears taken on surfaces throughout the building were analyzed on-site and indicated that transferable radioactivity levels were below the minimum detectable activity (MDA) for field instruments of 50 dpm/100 cm^2 for alpha contamination and 160 dpm/100 cm^2 for beta-gamma contamination.

CONCLUSIONS

Results of the independent radiological verification survey at the former Bridgeport Brass Company Facility confirm that, with the exception of some sections of the drain system inside the building, residual uranium contamination has been remediated to levels within DOE guidelines for FUSRAP sites inside and outside the Ruffert Building. Certain sections of the drain system retain uranium contamination above DOE surface guideline levels. These sections of pipe are addressed in separate, referenced documentation.[3,4]

REFERENCES

1. R. D. Foley and R. F. Carrier, *Radiological Survey Results at the Former Bridgeport Brass Company Facility, Seymour, Connecticut,* ORNL/TM-12225, Martin Marietta Energy Systems, Inc., Oak Ridge Natl. Lab., June 1993.

2. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, *Procedures Manual for the ORNL Radiological Survey Activities (RASA) Program,* ORNL/TM-8600, Martin Marietta Energy Systems, Inc., Oak Ridge Natl. Lab., April 1987.

3. Memo, J. W. Wagoner II, Director, Division of Off-Site Programs, Office of Eastern Area Programs, Office of Environmental Restoration, U.S. DOE, to L. K. Price, Director, Former Sites Restoration Division, Oak Ridge Field Office, U.S. DOE, August 10, 1993.

4. Memo, J. W. Wagoner II, Director, Division of Off-Site Programs, Office of Eastern Area Programs, Office of Environmental Restoration, U.S. DOE, to L. K. Price, Director, Former Sites Restoration Division, Oak Ridge Field Office, U.S. DOE, October 17, 1994.

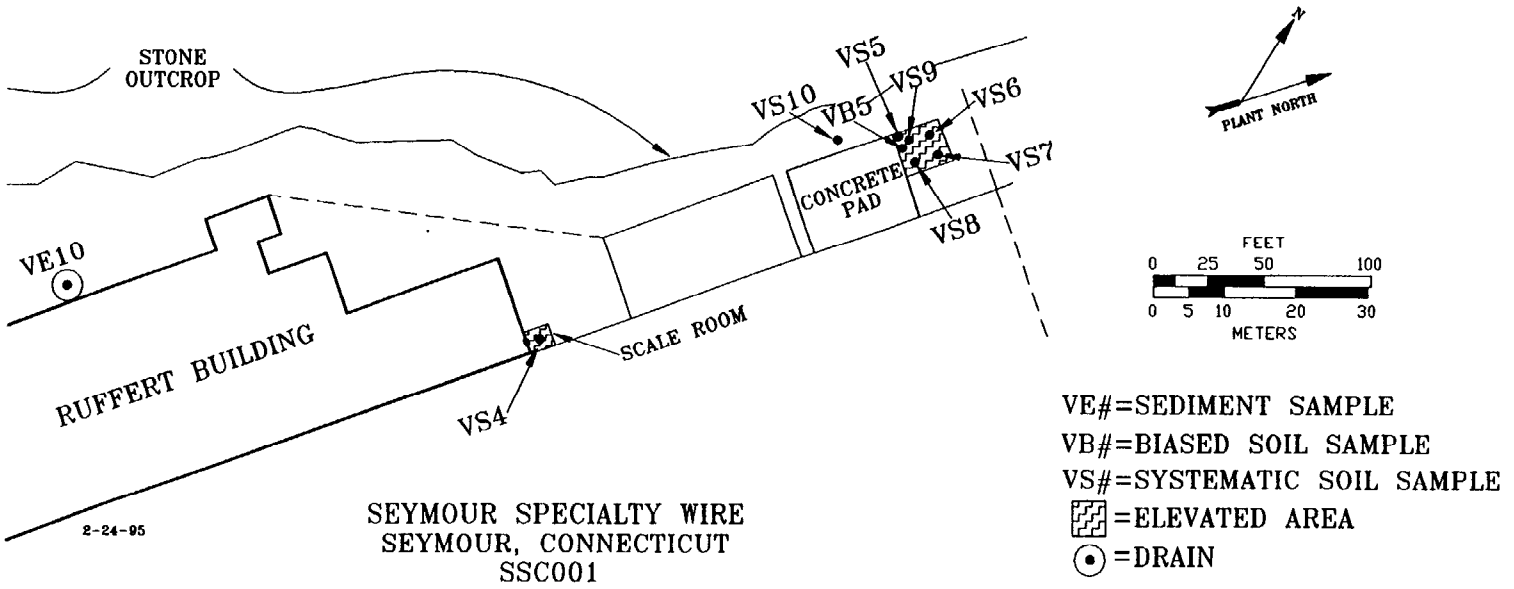

Fig. 1. Area outside the Ruffert Building showing locations of systematic, biased and sediment verification samples, and areas above DOE guidelines prior to remediation to levels below DOE guidelines.

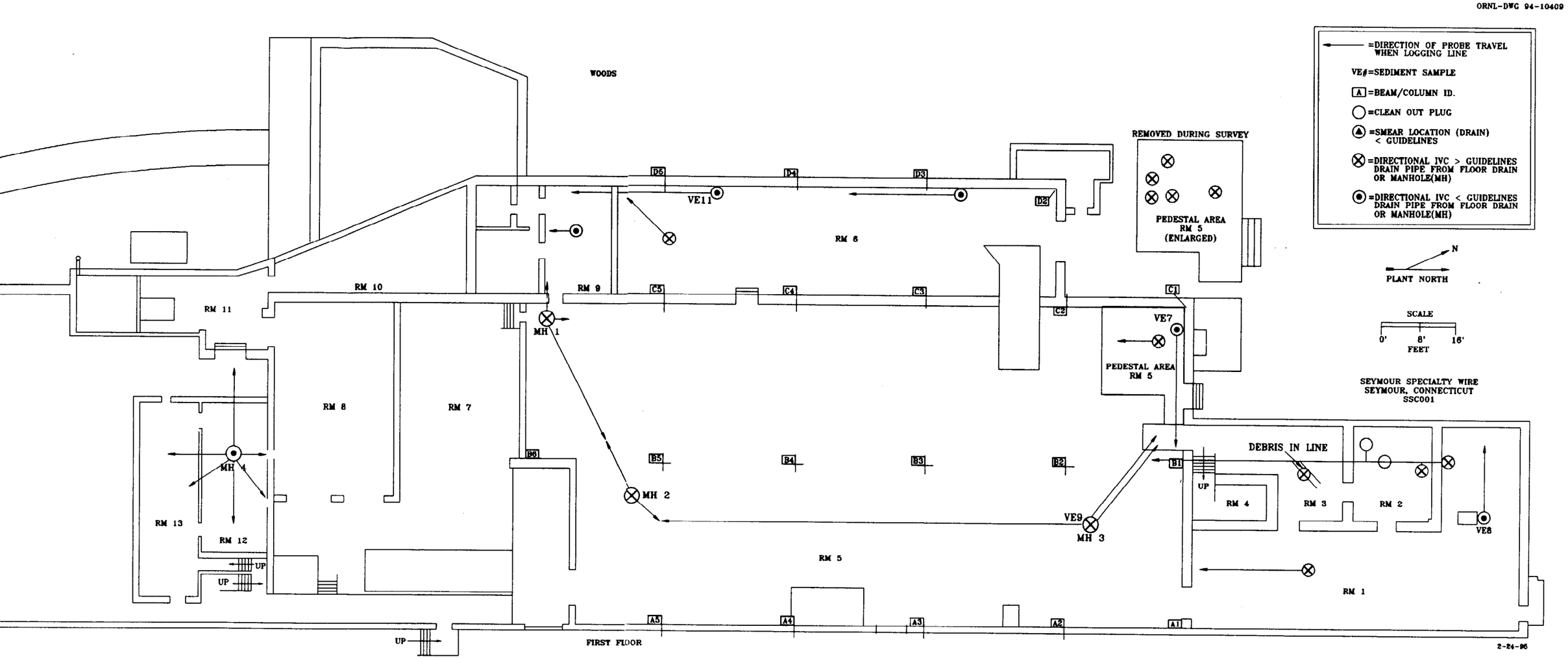

Fig. 2. Diagram of drain system, drainline sediment verification sample locations, and drain smear locations inside the Ruffert Building.

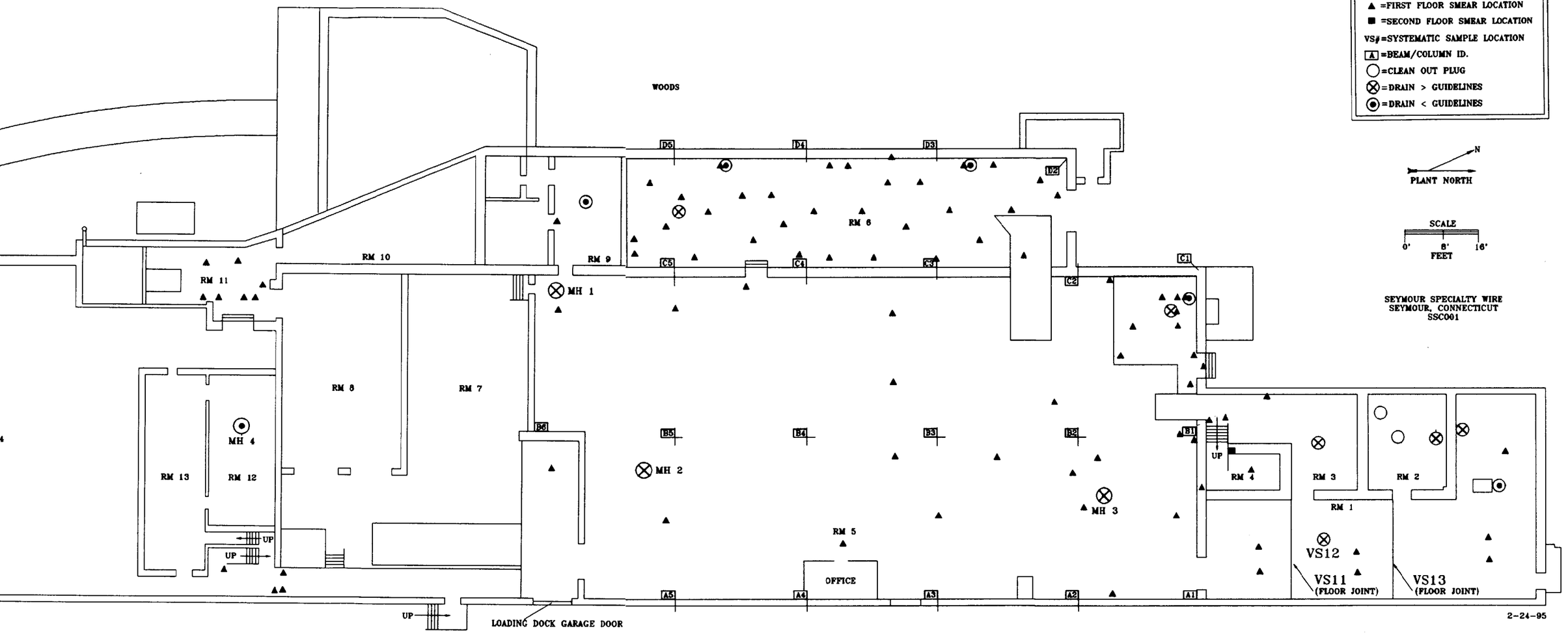

Fig. 3. Locations of systematic verification samples and smears from floors inside the Ruffert Building.

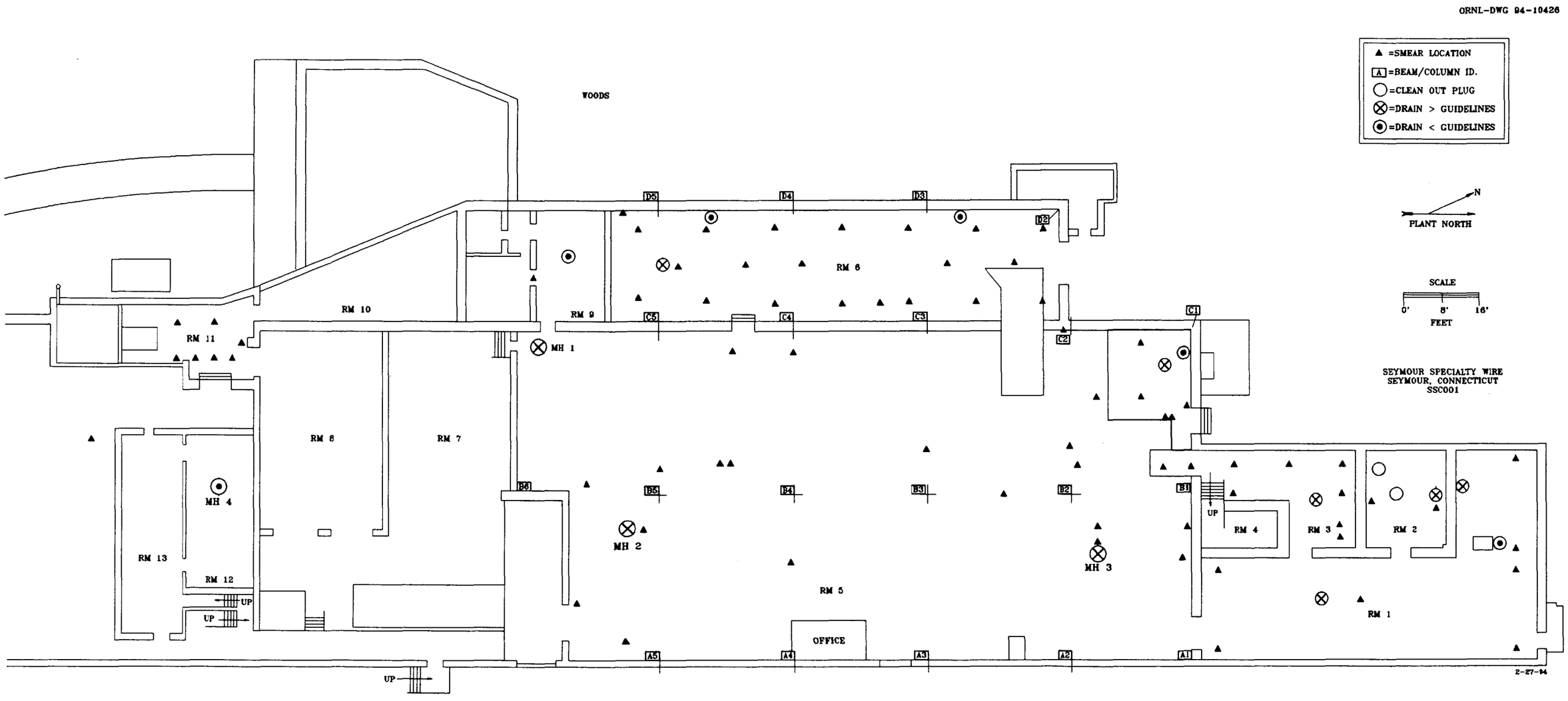

Fig. 4. Locations of overhead smears on the first floor of the Ruffert Building.

Table 1. Applicable guidelines for protection against radiation
(Limits for uncontrolled areas)

Mode of exposure	Exposure conditions	Guideline value
Gamma radiation	Indoor gamma radiation level (above background)	20 μR/h[a]
Total residual surface contamination[b]	^{238}U, ^{235}U, U-natural (alpha emitters)	
	Maximum	15,000 dpm/100 cm^2
	Average	5,000 dpm/100 cm^2
	Removable	1,000 dpm/100 cm^2
	^{232}Th, Th-natural (alpha emitters)	
	Maximum	3,000 dpm/100 cm^2
	Average	1,000 dpm/100 cm^2
	Removable	200 dpm/100 cm^2
	^{226}Ra, ^{230}Th, transuranics	
	Maximum	300 dpm/100 cm^2
	Average	100 dpm/100 cm^2
	Removable	20 dpm/100 cm^2
Beta-gamma dose rates	Surface dose rate averaged over not more than 1 m^2	0.20 mrad/h
	Maximum dose rate in any 100-cm^2 area	1.0 mrad/h
Radionuclide concentrations in soil (generic)	Maximum permissible concentration of the following radionuclides in soil above background levels, averaged over a 100-m^2 area	5 pCi/g averaged over the first 15 cm of soil below the surface; 15 pCi/g when averaged over 15-cm-thick soil layers more than 15 cm below the surface
	^{226}Ra	
	^{232}Th	
	^{230}Th	

Table 1 (continued)

Mode of exposure	Exposure conditions	Guideline value
Derived concentrations at similar FUSRAP sites	^{238}U	35 pCi/g[c]
Site-specific soil concentration limits for Seymour site[d]		As accomplished

[a]The 20 μR/h shall comply with the basic dose limit (100 mrem/year) when an appropriate-use scenario is considered.

[b]DOE surface contamination guidelines are consistent with *NRC Guidelines for Decontamination at Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for By-Product, Source, or Special Nuclear Material*, May 1987.

[c]DOE guidelines for uranium are derived on a site-specific basis.

[d]Memo, J. W. Wagoner II, Director, Division of Off-Site Programs, Office of Eastern Area Programs, Office of Environmental Restoration, U.S. DOE, to L. K. Price, Director, Former Sites Restoration Division, Oak Ridge Field Office, U.S. DOE, December 21, 1992.

Sources: Adapted from U.S. Department of Energy, DOE Order 5400.5, April 1990, and U.S. Department of Energy, *Guidelines for Residual Radioactive Material at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites*, Rev. 2, March 1987; and U. S. Department of Energy Radiological Control Manual, DOE N 5480.6 (DOE/EH-256T), June 1992.

Table 2. Background radiation levels and concentrations of selected radionuclides in soil in the Seymour, Connecticut, area

Type of radiation measurement or sample	Radiation level or radionuclide concentration
Gamma exposure rate at 1 m above ground surface (μR/h)[a]	8
Concentration of radionuclides in soil (pCi/g)[a]	
^{232}Th	0.9
^{226}Ra	0.9
^{238}U	0.9

[a]Values obtained from locations in northern New Jersey area, southwest of Bridgeport and Seymour, Connecticut.

Sources: U. S. Department of Energy, *Radiological Survey of the Middlesex Municipal Landfill, Middlesex, New Jersey,* DOE/EV-0005/20, April 1980; T. E. Myrick, B. A. Berven, and F. F. Haywood, *State Background Radiation Levels: Results of Measurements Taken During 1975–1979*, ORNL/TM–7343, Martin Marietta Energy Systems, Inc., Oak Ridge Natl. Lab., November 1981.

Table 3. Concentrations of radionuclides in soil and drain verification samples at the former Bridgeport Brass Company Facility, Seymour, Connecticut

Sample ID[a]	Depth (cm)	Radionuclide concentration (pCi/g)[b]			
		^{238}U	^{235}U	^{232}Th	^{226}Ra
		Systematic samples[c]			
VS4	0-5	7.8 ± 1.0	<0.29	0.84 ± 0.2	0.75 ± 0.1
VS5	0-10	20 ± 2	1.0 ± 0.1	0.83 ± 0.2	0.83 ± 0.1
VS6	0-15	1.1 ± 0.4	<0.17	1.1 ± 0.2	0.83 ± 0.1
VS7	0-15	1.8 ± 0.2	0.08 ± 0.03	1.2 ± 0.2	0.91 ± 0.1
VS8	0-15	2.7 ± 0.4	<0.15	1.1 ± 0.2	0.79 ± 0.1
VS9	0-15	<1.5	<0.20	1.3 ± 0.2	0.93 ± 0.1
VS10	granite	3.0 ± 1.0	0.14 ± 0.06	1.9 ± 0.06	1.5 ± 0.04
VS11	soil composite	1.9 ± 0.3	<0.20	0.84 ± 0.2	0.77 ± 0.1
VS12	soil composite	1.2 ± 0.5	<0.12	0.82 ± 0.2	0.77 ± 0.1
VS13	soil composite	1.1 ± 0.3	<0.14	0.79 ± 0.03	0.74 ± 0.02
		Biased sample[d]			
VB5	0-15	2.5 ± 0.5	0.17 ± 0.04	1.1 ± 0.2	0.88 ± 0.09
		Floor drainline sediment samples			
VE7	drain	100 ± 20	5.0 ± 2.0	*e*	<3.8
VE8	drain	320 ±20	16 ± 6	*e*	<20
VE9	drain	2400 ± 200	110 ± 20	26 ± 2	1.4 ± 0.5
VE10	drain	1.6 ± 0.5	<0.09	0.74 ± 0.02	0.66 ± 0.02
VE11	drain	3.4 ± 0.6	<0.22	1.06 ± 0.2	0.75 ± 0.09

[a]Sample locations are shown in Figs. 1, 2, and 3.
[b]Indicated counting error is at the 95% confidence level (±2σ).
[c]Systematic samples are taken at locations irrespective of gamma exposure rates.
[d]Biased samples are taken from areas with elevated gamma exposure rates.
[e]Sample not analyzed for ^{232}Th.

INTERNAL DISTRIBUTION

1. J. F. Allred
2. B. A. Berven
3–5. K. J. Brown
6. R. F. Carrier
7–11. R. D. Foley
12. R. O. Hultgren
13. C. A. Johnson
14. M. E. Murray
15. P. T. Owen
16. D. E. Rice
17. D. A. Roberts
18. R. E. Rodriguez
19. R. E. Swaja
20. M. S. Uziel
21. J. K. Williams
22–23. Laboratory Records
24. Laboratory Records - RC
25. Central Research Library
26. ORNL Technical Lib., Y–12
27. ORNL Patent Section
28–33. MAD Records Center

EXTERNAL DISTRIBUTION

34. W. L. Beck, Oak Ridge Associated Universities, E/SH Division, Environmental Survey and Site Assessment Program, P.O. Box 117, Oak Ridge, TN 37831-0117

35. P. Doolittle, Booz-Allen & Hamilton, Inc., 4330 East-West Highway, Bethesda, MD 20814

36. J. J. Fiore, Director, Office of Eastern Area Programs, Office of Environmental Restoration, U.S. Department of Energy, 4th Floor, 656 Quince Orchard Rd., Gaithersburg, MD 20878

37-42. R. R. Harbert, Bechtel National, Inc., FUSRAP Department, Oak Ridge Corporate Center, 151 Lafayette Drive, P.O. Box 350, Oak Ridge, TN 37831-0350

43-45. J. King, Science Applications International Corp., P.O. Box 2501, 301 Laboratory Road, Oak Ridge, TN 37831

46. L. K. Price, Director, Former Sites Restoration Division, Oak Ridge Field Office, U.S. Department of Energy, P.O. Box 2001, Oak Ridge, TN 37831-8723

47. J. W. Wagoner II, Director, Division of Off-Site Programs, Office of Eastern Area Programs, Office of Environmental Restoration, U.S. Department of Energy, 4th Floor, 656 Quince Orchard Rd., Gaithersburg, MD 20878

48–52. W. A. Williams, Designation and Certification Manager, Division of Off-Site Programs, Office of Eastern Area Programs, Office of Environmental Restoration, U.S. Department of Energy, 4th Floor, 656 Quince Orchard Rd., Gaithersburg, MD 20878

53-54. Office of Scientific and Technical Information, U.S. Department of Energy, P.O. Box 62, Oak Ridge, TN 37831